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INT CL[5] G01C, G01S, G03B

(54) Range meter for a camera

(57) A range meter for a camera comprises light-projecting means (IR1, IR2, IR3, LS1) for projecting a plurality of irradiation beams in different directions towards subjects (SB1, SB2, SB3) capable of being photographed and selecting means (RL) for manually selecting a desired one of the irradiation beams for irradiation of a desired subject. Light-receiving means (PT) are provided for receiving reflected light from the desired subject which has been irradiated with the selected irradiation beam and are arranged to provide an output signal corresponding to the position thereon of the said reflected light which is received from the desired subject in a longitudinal direction. Arithmetic means (OP) for calculating from the said output signal the distance to the desired subject are connected to the light receiving means. By appropriately selecting the irradiation beam focussing can be effected of a desired subject even when the latter is not positioned closest to the camera.

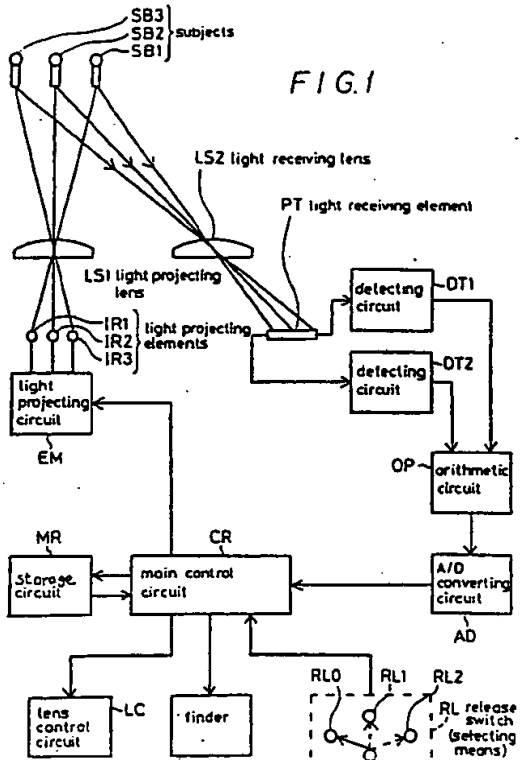

FIG.1

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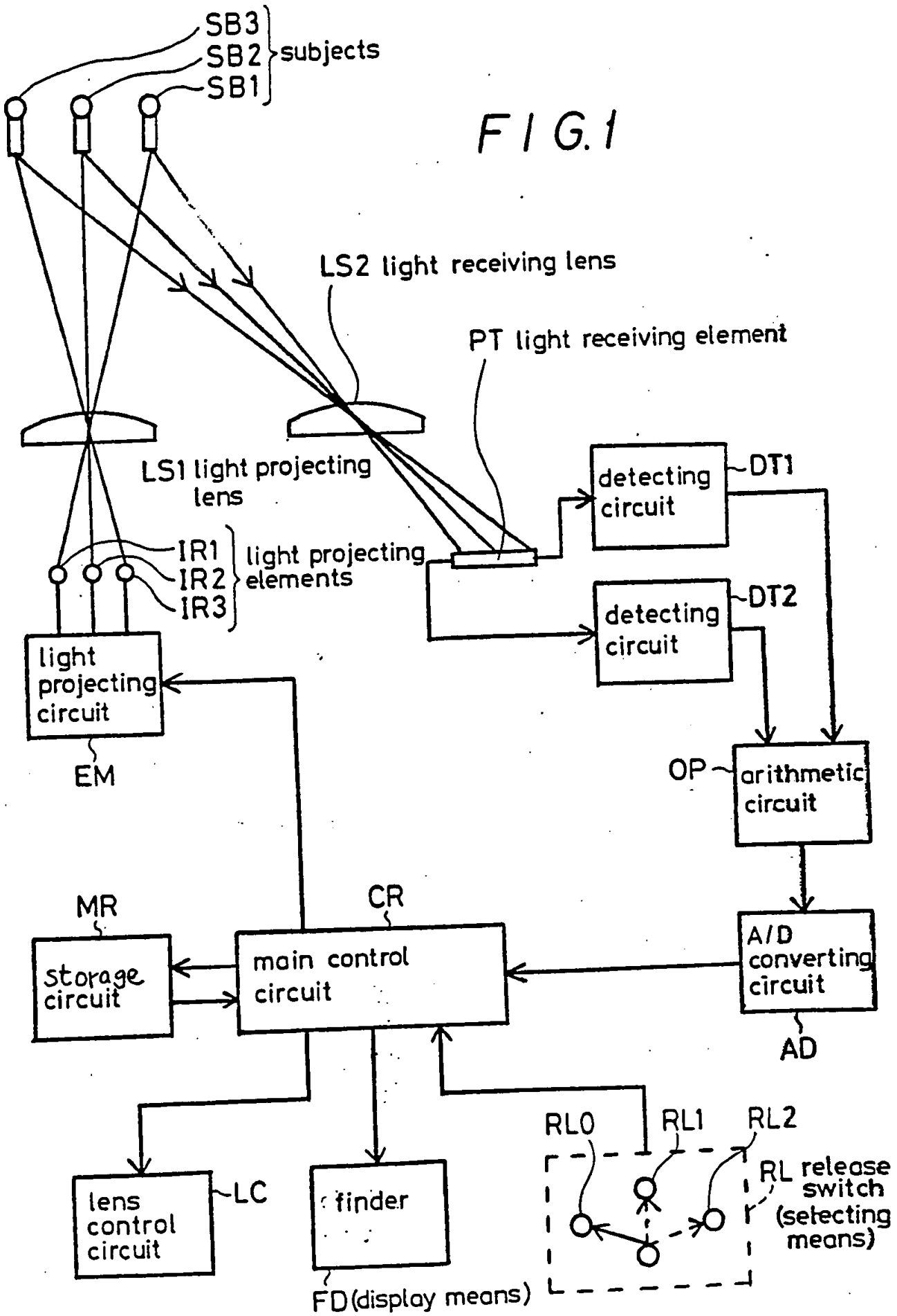

SB3
SB2
SB1
subjects
LS2 light receiving lens
PT light receiving element
LS1 light projecting lens
IR1
IR2
IR3
light projecting elements
detecting circuit
DT1
detecting circuit
DT2
light projecting circuit
EM
OP
arithmetic circuit
MR
CR
storage circuit
main control circuit
A/D converting circuit
AD
RL0
RL1
RL2
RL release switch (selecting means)
lens control circuit
LC
finder
FD(display means)

FIG. 1

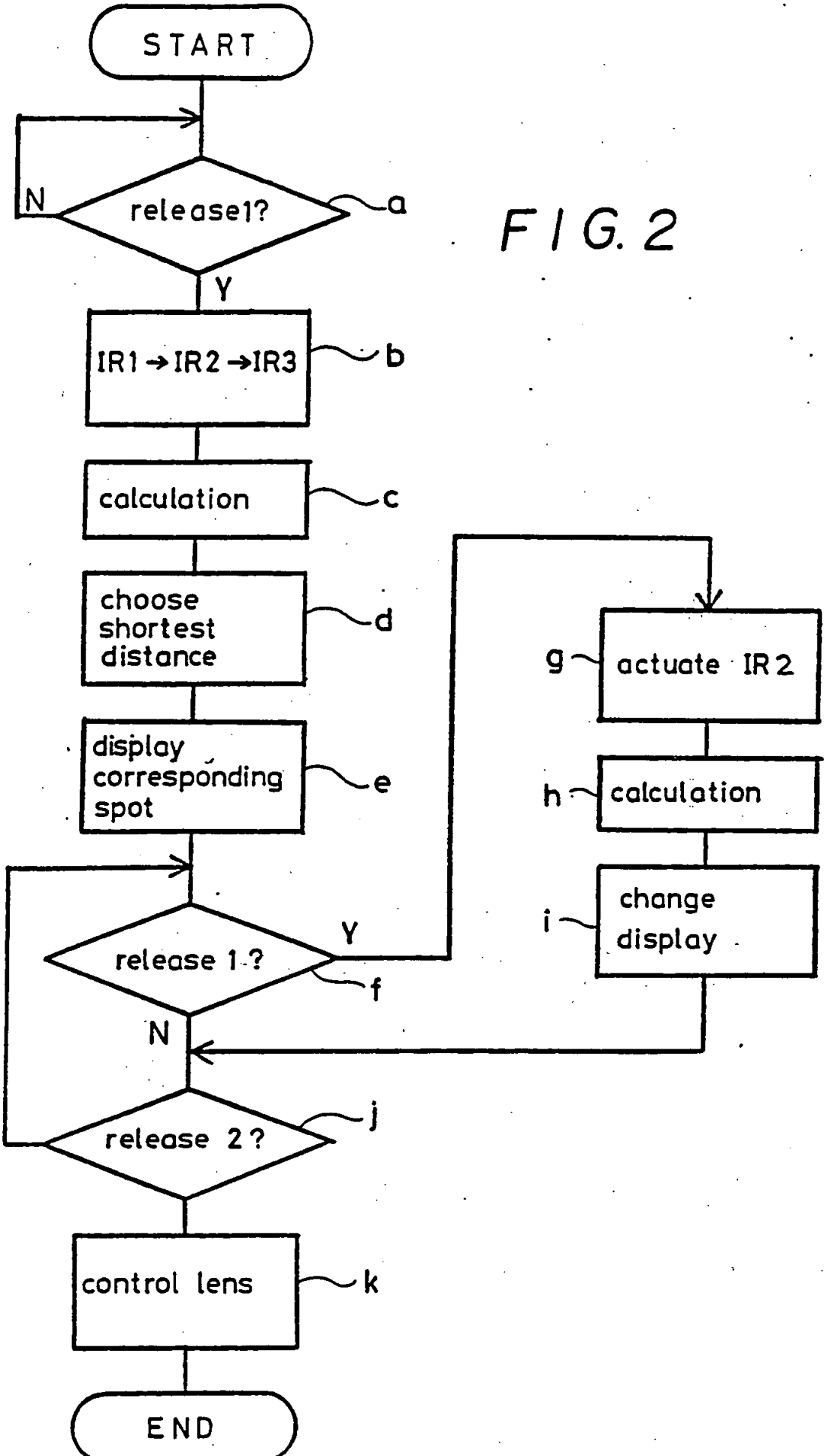

START
release1?
N
Y
a
IR1 → IR2 → IR3
b
calculation
c
choose shortest distance
d
display corresponding spot
e
release 1?
f
Y
N
g
actuate IR2
h
calculation
i
change display
release 2?
j
control lens
k
END

FIG. 2

FIG. 3 (A)

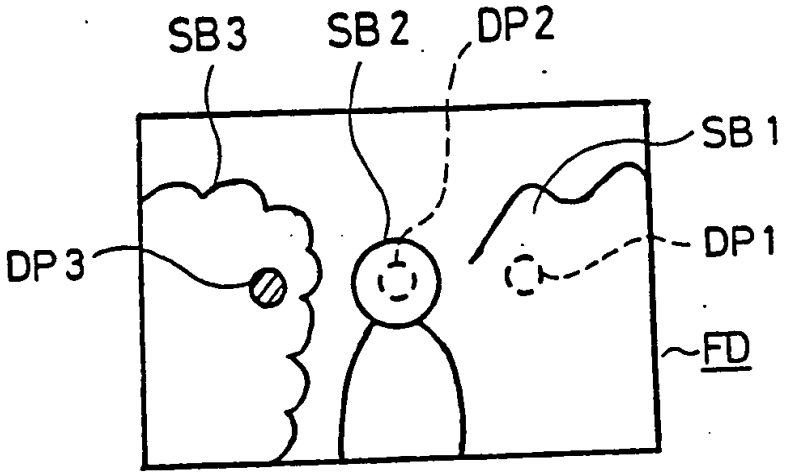
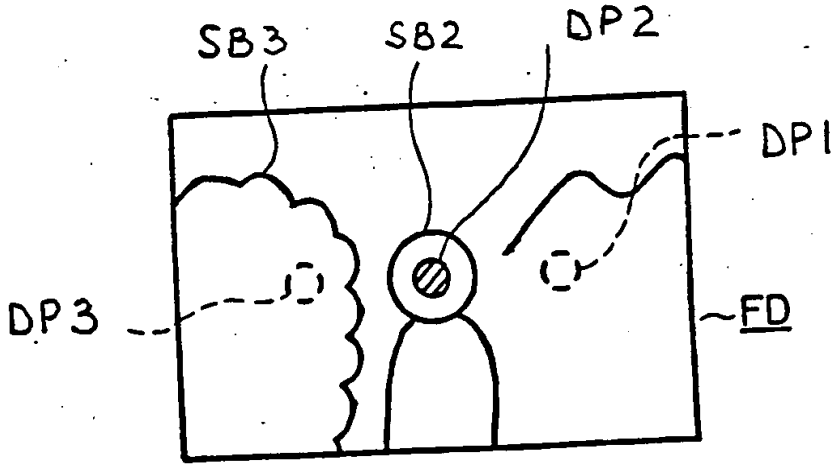


FIG. 3 (B)



"RANGE METER FOR A CAMERA"

This invention relates to a range meter for a camera.

In automatic focusing, (AF type) cameras, the distance from the camera to a subject to be photographed is generally measured in accordance with a triangulation method. In this method, an infrared beam is projected from a light-projecting element towards the subject, the reflected light from the subject is received by a light-receiving element, and the distance to the subject is calculated on the basis of the light-reception point on the light-receiving element.

In such a method as above wherein only one light-projecting element is used, however, it is difficult to obtain the distance correctly unless the subject is positioned at the centre of a viewfinder. Consequently, a so-called multi-automatic focusing (multi AF type) range meter is also known (see, for example, Japanese Laid Open Specification No. 62-223734) which uses a plurality of light-projecting elements. In this multi AF type range meter, a plurality of subjects located in different directions are irradiated by the light-projecting elements, the individual distances to the subjects are calculated, and the shortest one among them is chosen as the basis for the indication of distance.

A camera having the foregoing multi AF type range meter, however, is inevitably focused on the subject closest thereto, and consequently it is inconvenient where a desired subject is not positioned closest to the camera.

It is an object of the present invention to

provide a range meter for multi AF type cameras in which focusing can be effected of a desired subject even when the latter is not positioned closest to the camera.

According, therefore, to the present invention, there is provided a range meter for a camera comprising light-projecting means for projecting a plurality of irradiation beams in different directions towards subjects capable of being photographed; selecting means for manually selecting a desired one of the irradiation beams for irradiation of a desired subject; light-receiving means for receiving reflected light from the desired subject which has been irradiated with the selected irradiation beam, the light-receiving means being arranged to provide an output signal corresponding to the position thereon of the said reflected light which is received from the desired subject in a longitudinal direction; and arithmetic means for calculating from the said output signal the distance to the desired subject.

The selecting means may be manually movable from an inoperative position to an operative position, movement of the selecting means from the inoperative to the operative position for the first time causing a predetermined irradiation beam to be selected, each subsequent movement of the selecting means back to the inoperative position and then on to the operative position causing a different irradiation beam to be selected. In this case, the said predetermined radiation beam is preferably that which irradiates the subject closest to the range meter.

Alternatively, the selecting means may be manually movable from an inoperative position to an operative position, movement of the selecting means from the inoperative to the operative position causing each

irradiation beam to be successively selected in turn.

The selecting means may also have a shutter operating position to which the selecting means may be moved when the desired irradiation beam has been selected.

The range meter is preferably provided with a viewfinder which indicates the position of the subject which is being irradiated with the selected irradiation beam.

The arithmetic means may form part of a control means, the said control means comprising a light-projecting circuit for causing the light-projecting means to effect successive emission of the said plurality of irradiation beams so that the arithmetic means successively produces respective output signals.

The control means may effect selection of the smallest of the said output signals.

The invention also comprises a camera provided with a range meter as set forth above.

The invention is illustrated, merely by way of example, in the accompanying drawings, in which:-

Figure 1 is a block diagram showing an embodiment of the present invention;

Figure 2 is a flowchart showing the operation of the embodiment of Figure 1, and

Figures 3(A) and 3(B) are a set of views showing the operation of selecting a subject to be photographed.

In Figure 1, there is shown a range meter according to the present invention which comprises light-projecting elements IR1, IR2 and IR3 each of which has a light emitting diode for emitting far infrared light. The light-projecting elements IR1, IR2 and IR3 are arranged in a row in front of a camera (not shown).

LS1 is a light-projecting lens for projecting the light from each of the light-projecting elements IR1,

IR2 and IR3 to form corresponding irradiation beams travelling in different directions.

The light-projecting elements IR1, IR2 and IR3 and the light-projecting lens LSI together constitute a light projecting means.

EM is a light-projecting circuit for controlling the light emission of the light-projecting elements IR1, IR2 and IR3.

PT is a light-receiving element which comprises photodiodes and which receives the reflected light from each of subjects SB1, SB2 and SB3 which are capable of being photographed so as to provide in each case an output signal corresponding to the position on the light-receiving element PT of the light received from the respective subject in the longitudinal direction. The light-receiving element PT is disposed in front of the camera.

LS2 is a light-receiving lens for focusing the reflected light from each subject SB1, SB2, SB3 onto the light-receiving element PT.

DT1 and DT2 are detecting circuits for detecting output signals from opposite ends of the light-receiving element PT.

OP is an arithmetic circuit for providing an output signal corresponding to the distance to the subject on the basis of the output signals of the detecting circuits DT1 and DT2.

AD is an A/D (analog to digital) converting circuit for converting the output signal of the arithmetic circuit OP from analog to digital form to provide a range value.

MR is a storage circuit comprising a ROM (read-only memory). The storage circuit MR holds conversion coefficients used in converting the range value which is

outputted from the A/D converting circuit AD into a real distance value.

CR is a main control circuit for controlling the whole system. The main control circuit CR receives the output from the A/D converting circuit AD and is connected to the storage circuit MR so as to pass output signals thereto and so as to receive input signals therefrom.

LC is a lens control circuit for controlling the position of the lens of the camera in response to the distance information from the main control circuit CR.

RL is a release switch acting as selecting means which comprises a push switch depressible in two stages. When depressed to the first stage, the release switch RL moves from a normal position RL0 and selects a switch terminal RL1 so that the distance to the subject is measured. When depressed to the second stage, it selects a switch terminal RL2 so that a shutter is opened to perform shooting.

FD is a viewfinder acting as a display means. The viewfinder FD has the function of displaying a focused spot in addition to the ordinary functions of a viewfinder. Such a display function may be attained by the use of a liquid crystal panel, for example.

The operation of the embodiment of the invention shown in Figure 1 will be described with reference to the flowchart of Figure 2.

When the release switch R1 is depressed to the first stage, the switch terminal RL1 is selected to start a series of operations as follows. [Step (a)].

The light-projecting circuit EM, upon receipt of a control signal from the main control circuit CR, causes the light-projecting elements IR1, IR2 and IR3 to successively emit light in a time-sharing manner. The

irradiation beams from the light-projecting elements IR1, IR2 and IR3 are successively reflected by the corresponding subjects SB1, SB2 and SB3, the individual reflected light being received by the light-receiving element PT in succession [Step (b)].

The light-receiving element PT provides an output signal corresponding to each light-reception point thereon at which light is received from the subject in the longitudinal direction, the output signal being detected by the detecting circuits DT1 and DT2. The arithmetic circuit OP successively processes the output signals of the detecting circuits DT1 and DT2. Each calculation result is converted in the A/D converting circuit AD from analog to digital form, each value in digital form being sent to the main control circuit CR in succession as a range value [Step (c)].

The main control circuit CR chooses the smallest one out of the range values sent thereto. That is, the range value corresponding to the one out of the subjects SB1, SB2 and SB3 that is positioned closest to the camera is chosen. The thus chosen range value is converted into a real distance value on the basis of the conversion data held in the storage circuit MR. [Step (d)].

Figures 3(A) and 3(B) show the viewfinder as viewed. For example, when the subject SB3 is positioned closest to the camera, a display pointer DP3 is displayed as illustrated in Figure 3(A). [Step (e)].

If it is then desired that focusing be made to the subject SB2 or SB1 which is positioned more remote from the camera than the subject SB3, the following control is performed.

After returning the release switch RL to its normal position RLO, the release switch RL is depressed

once again to the first stage, so that the switch terminal RL1 is selected. [Step (f)].

As a result, the main control circuit CR sends a control signal to the light-projecting circuit EM, so that the light-projecting element IR2 emits light in response to the signal from the light-projecting circuit EM [Step (g)]. The irradiation beam from the light-projecting element IR2 is reflected by the subject SB2, the reflected light being received by the light-receiving element PT. The output signals of the light-receiving element PT are detected by the detecting circuits DT1 and DT2, and after being processed, are converted from analog to digital form. [Step (h)].

The main control circuit CR converts the range value in digital form into the real distance value on the basis of the conversion data held in the storage circuit MR. In the viewfinder, a display pointer DP2 is displayed as illustrated in Figure 3(B). [Step (i)].

If it is desired that focusing be made to the subject SB1, after returning the release switch RL once again to its normal position RLO, the release switch RL is depressed to the first stage, so that the switch terminal RL1 is again selected. [Step (f)].

In this way, each time the switch terminal RL1 is selected, the light projecting elements IR1, IR2 and IR3 are cyclically selected one at a time, and correspondingly, the display pointers DP1, DP2 and DP3 are cyclically displayed one at a time.

After a desired subject is selected in the foregoing manner, the release switch RL is depressed further to the second stage, so that the switch terminal RL2 is selected [Step (j)].

When the switch terminal RL2 is selected, the lens control circuit LC controls the position of the lens of

the camera on the basis of the distance value given from the main control circuit CR. [Step (k)]. Subsequently, the shutter is opened to perform shooting.

In this way, the foregoing series of operations is performed when shooting.

The embodiment described above may be modified such that with the release switch RL kept to the switch terminal RL1, the light-projecting elements IR1, IR2 and IR3 as well as the display pointers DP1, DP2 and DP3 are successively selected one at a time automatically at time intervals of 1 to 2 seconds, and when the display pointer comes to the position of a desired subject, the user controls the release switch RL to select the switch terminal RL2.

In the embodiment described above, since a desired subject can be selected by manually selecting one out of the plurality of irradiation beams projected from the light projecting means, focusing can be reliably made to any desired subject.

CLAIMS

1. A range meter for a camera comprising light-projecting means for projecting a plurality of irradiation beams in different directions towards subjects capable of being photographed; selecting means for manually selecting a desired one of the irradiation beams for irradiation of a desired subject; light-receiving means for receiving reflected light from the desired subject which has been irradiated with the selected irradiation beam, the light-receiving means being arranged to provide an output signal corresponding to the position thereon of the said reflected light which is received from the desired subject in a longitudinal direction; and arithmetic means for calculating from the said output signal the distance to the desired subject.

2. A range meter as claimed in claim 1 in which the selecting means is manually movable from an inoperative position to an operative position, movement of the selecting means from the inoperative to the operative position for the first time causing a predetermined irradiation beam to be selected, each subsequent movement of the selecting means back to the inoperative position and then on to the operative position causing a different irradiation beam to be selected.

3. A range meter as claimed in claim 2 in which the said predetermined irradiation beam is that which irradiates the subject closest to the range meter.

4. A range meter as claimed in claim 1 in which the selecting means is manually movable from an inoperative position to an operative position, movement of the selecting means from the inoperative to the operative position causing each irradiation beam to be successively selected in turn.

5. A range meter as claimed in any of claims 2-4 in which the selecting means has a shutter operating position to which the selecting means may be moved when the desired irradiation beam has been selected.

6. A range meter as claimed in any preceding claim in which the range meter is provided with a viewfinder which indicates the position of the subject which is being irradiated with the selected irradiation beam.

7. A range meter as claimed in any preceding claim in which the arithmetic means forms part of a control means, the said control means comprising a light-light-projecting circuit for causing the light-projecting means to effect successive emission of the said plurality of irradiation beams so that the arithmetic means successively produces respective output signals.

8. A range meter as claimed in claim 7 when dependent upon claim 3 in which the control means effects selection of the smallest of the said output signals.

9. A range meter substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

10. A camera provided with a range meter as

claimed in any preceding claim.

11. A range meter for cameras comprising light projecting means for projecting a plurality of irradiation beams in different directions, selecting means for manually selecting a desired one out of the plurality of the irradiation beams, light-receiving means for receiving the reflected light from a subject of shooting irradiated with the irradiation beam selected by the selecting means to provide an output signal corresponding to a light-received point in its longitudinal direction, and arithmetic means for calculating the distance to the subject on the basis of the output signal of the light receiving means.

12. A range meter for cameras according to claim 11, further including display means for providing a display corresponding to a spot irradiated with the irradiation beam selected by the selecting means.

13. Any novel integer or step, or combination of integers or steps, hereinbefore described and/or shown in the accompanying drawings, irrespective of whether the present claim is within the scope of, or relates to the same or a different invention from that of, the preceding claims.